

Electric Vehicle/Alternative Fuel Subgroup: Findings of the Montgomery County Transport GHG Scenarios Analysis

Approach

The EV subgroup took a “broad and shallow” approach to researching and analyzing what would be needed to reach the County’s goals of an 80% reduction in greenhouse gases (GHG) by 2027 and a 100% reduction in GHG by 2035. We reviewed previous county, state, and regional reports to identify proposed actions that were already identified and considered. We looked at best practices in many other jurisdictions, as well as national programs, both current and past. We did preliminary research into industry innovation, and scoured news reports for new developments.

We then developed two products:

- A spreadsheet of recommended actions, as requested by the county, divided into separate sheets which discuss options for the various components of vehicle transformation planning (personal EVs, charging network, alternative vehicle types, transit and heavy-duty vehicles, county fleets, and other fleets, as well as recommended external advocacy)
- A spreadsheet to analyze the GHG emission reductions that would likely result from various combinations of increased EV sales, increased ICE retirements, and decreased VMT, and this summary document which describes what we have found through this analysis.

Recommendation summary

We developed a spreadsheet to address electric and alternative fuel transition in 7 categories:

- Personal EVs
- Charging Network
- Alternative Vehicle Types
- Transit
- Medium- and Heavy-Duty Vehicles
- Montgomery County Fleets
- Other Fleets
- Advocacy (noting that the county should use its influence with the state, region, and country)

The spreadsheet includes 28 objectives, 63 associated strategies, and 125 individual actions, which we then prioritized. The objectives and strategies are listed at the end of this document; the entire spreadsheet, including the individual actions and prioritization, are submitted separately.

Sobering results

The EV subgroup created a qualitative spreadsheet using Google Sheets to help us see what kind of EV adoption, early ICE vehicle retirement, and/or VMT reductions might be needed to achieve the county’s goal of an 80% GHG reduction by 2027. What we found was very sobering.

If our spreadsheet analysis is correct, the county would be able to achieve the “80 by 27” (80% GHG reduction by 2027) in the county’s transportation sector only with extraordinary measures that have not been seen before.

While electrification of passenger cars and a number of other vehicles are technologically feasible today, there are many other vehicle types (generally, those that require more power or have other specialized needs) that have not yet been demonstrated to be workable. Although it is likely that such technology will develop, we made the simplifying assumption that vehicles that are not ready to transition today would generally not transition until after 2027. Therefore, to reach the 2027 goal of 80% reduction of GHG, we aimed to reach 100% electrification where possible. This would allow the more challenging vehicle types, and other non-vehicular contributors of GHGs that cannot be totally controlled today, to make up the more difficult remaining 20% of emissions (which would need to be eliminated 2027-2035).

Using the simple spreadsheet tool we developed, the only way to achieve the “80 by 27” (80% GHG reduction by 2027) in the county’s vehicles is if ALL of the following were to happen:

- 100% of all new and used MoCo vehicles sales must be EV (not hybrid) starting 2021
- The annual rate of ICE vehicle retirement must be tripled, beginning in 2021, with all retired vehicles being ICE vehicles and all retired vehicles being replaced by EVs, transit, or other electric transportation (this would lead to NO ICE automobiles, buses, and most light/medium duty commercial vehicles on the road by 2027)
- EVs produce zero GHG emissions (or, if the lifecycle emissions that are produced by EVs are left out of the Montgomery County calculations)

It would be extremely challenging for the county to achieve these transformative changes in society. Working alone (without the benefit of strong state, regional, and federal action), it is almost beyond comprehension. For example, we cannot conceive of how the county government on its own would get everyone in the county--individuals, private fleet owners, and government fleet owners--to only purchase EVs starting in 2021. This would also imply that, for vehicles where electric models are not yet available on a mass scale (e.g., minivans, certain types of pickup trucks, certain types of SUVs), buyers would substitute with other electric vehicles or put off replacement. What policy tool does the county have to accomplish this?

To put these kinds of societal changes into context, we reviewed the experiences of other programs to date. After reviewing the literature on the impact of Cash for Clunker and related vehicle retirement programs, we have found little evidence that a municipality like MoCo could accelerate ICE vehicle retirements by 50%, let alone 200%. According to the [Congressional Research Service](#), the Obama Administration offered rebates between \$3500 and \$4500 per vehicle to boost vehicle fuel economy of up to 440,000 vehicles, spending \$3 billion between July 24, 2009 and August 24, 2009. If MoCo boosted ICE vehicle retirement by 50% through such an incentive causing about 200,000 ICE vehicles by 2027, it would cost the county between \$700 and \$930 million. For comparison, MoCo’s 2020 operating budget was \$5.8 billion. This does not include the costs of other necessary improvements such as upgrading Montgomery County fleets and the installation of a charging network.

As another point of comparison, Los Angeles has recently launched an initiative to electrify vehicles in advance of the 2028 Olympic Games. Their goal is a 25% cut in GHG and a target “30% of L.A.-area personal passenger vehicles on the road (and 80% of new vehicles sold) being electric... Electric fueling infrastructure is key to hitting those goals, so the plan includes installing 84,000 public chargers”.¹

If only some of these changes are made (say, if retirements increased by only 50% and VMT is reduced by 50% - still dramatic changes), this would only achieve about a 72% GHG reduction from passenger vehicles alone. And given how difficult it would be the county to reduce other transport sector emissions--aviation, construction equipment, heavy duty vehicles, etc.--we would expect net county transport GHG emissions reductions to be even less than 72%.

Even considering such a “scaled-down” approach, we do not think there is an example anywhere in the world where a municipality the size of MoCo achieved a 50% reduction in VMT in seven years even with the support of the federal or state/provincial governments. We cannot imagine a policy tool--TDM, urban planning, etc.--the county has to achieve such an unprecedented VMT reduction even with major policy action by the federal and state governments. And even if the federal and state governments took immediate and very aggressive action to encourage the purchase of EVs, a delay of a year or two in the implementation of such actions would probably put the “80 by 27” goal out of reach.

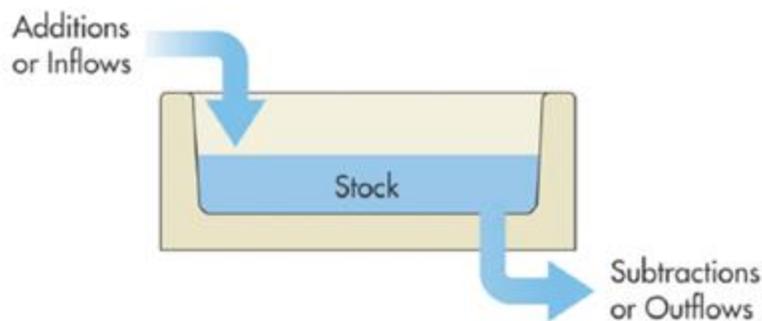
Finally, assuming that EVs emit zero GHG emissions is only credible if the electric grid somehow becomes 100% renewable or nuclear by 2027. Maryland’s RPS (Renewable Portfolio Standard) requires 45.5% of the state’s energy consumption to be renewable by 2027. Even assuming that all of the renewable energy is zero-carbon (which is not true today and is unlikely to be true by 2027 without significant state legislative changes), combining the 45.5% with the 34% of MD electricity coming from zero GHG nuclear energy yields just 79.5% zero GHG.

County achievement of these goals is likely possible only via a combination of major federal action, major state action, and/or major technical and societal breakthrough changes, coupled with a strong County commitment to force action.

Why such sobering preliminary findings?

These sobering results stem in part from the “stock and flows” issue. See the diagram below.

Stock is the name for the existing set of something, in this case the number of vehicles in use in the county. Flows is the name for the number of new items flowing into stock and the number of items leaving that stock. Like a bathtub filled with hot water, the “stock” of hot water will take a very long time to cool if a relatively small amount of cold water is flowing into the bathtub and a relatively small amount of the hot water in the bathtub is flowing out of the bathtub via the drain.



Likewise, the existing stock of approximately 800,000 mostly ICE vehicles in the MoCo stock will take a very long time to change over to become mostly EVs if the flow of new EV vehicles into the stock is relatively low and the flow of ICE vehicles leaving the stock is also relatively low.

The GHG emissions of passenger vehicles (LDV or Light Duty Vehicles) depends on types of vehicles in use--the stock--and miles traveled by those vehicles in the stock. Or to be a bit more technical, GHG emissions of passenger vehicles depends on the emissions per mile of all of the vehicles driving in MoCO times the number of miles traveled by these vehicles.

If there are 800,000 vehicles in use today in MoCo--the stock--and there are only about 60,000 new vehicles purchased in the MoCO each year--flowing in--and about 60,000 retired each year--flowing out--then it will take a very long time for that stock to turnover. Even if all the new vehicles flowing into that stock are EV and all of the retired vehicles are ICE, it will take about 14 years for all 800,000 to become EVs.

So, when could MoCo transport get to an 80% GHG reduction?

Using the crude spreadsheet we developed, we believe a nearly 80% GHG reduction might be possibly by 2040. This is based on the following aggressive but probably still realistic assumptions:

- 100% of new MoCo vehicles purchased are EV by 2035 (continued thru 2040)
 - scaled up from 1.1% in 2020
- 12% accelerated ICE vehicle retirement by 2030 (continued thru 2040)
 - scaled up gradually from 0% in 2020
- All vehicle retirements are ICE starting in 2021 (continued thru 2040)
 - all replaced by EV
- 15% VMT reduction by 2040
 - scaled up gradually from 0% in 2020

What kind of GHG reduction in MoCo transport achievable by 2027?

Using the crude spreadsheet we developed, we believe a 15% GHG reduction might be possibly by 2027 with a very aggressive set of policies and optimistic technology development (e.g., a

large number and variety of EVs available within a few years). This is based on the following aggressive but probably still realistic assumptions:

- 50% of new MoCo vehicles purchased are EV by 2027
 - scaled up from 1.1% in 2020
- 10% accelerated ICE vehicle retirement by 2027
 - scaled up gradually from 0% in 2020
- All vehicle retirements are ICE
 - all replaced by EV
- 6% VMT reduction by 2027
 - scaled up gradually from 0% in 2020

Data and analysis issues

We used the most credible data we could find in our analysis including data from: California Air Resources Board, Congressional Research Service, MD DOT, U.S. Energy Information Administration, U.S. Department of Energy, Argonne National Laboratory, National Renewable Energy Laboratory, Edison Electric Institute, and other sources.

However, please note that there are a number of important simplifying assumptions in our analysis. The most significant of these are listed below, along with a note on whether the assumption is likely to lead to an overestimate or underestimate of remaining GHG emissions):

- No MoCo population growth (results in underestimate)
- No baseline VMT growth (results in underestimate)
- Each year, the baseline number of MoCo vehicles retired each year is equal to the number of new MoCo vehicles purchased each year (results in underestimate)
- The emissions per mile for EVs and ICE cars does not change over time (results in overestimate)
- Emissions factor for EVs is based on EVs with 200+ mile range (uncertain)

Many of the simplifying assumptions make our scenarios seem rosier than they would otherwise be. For example, a more sophisticated analysis would likely show significant baseline growth in vehicle miles traveled due to at least expected population growth in MoCo. That would make the results even more sobering.

Final thoughts

“A journey of a thousand miles begins with a single step.” - LaoTzu, 601-531 BCE
While our data shows that it will take longer than 2027 for transportation to reach an 80% reduction in greenhouse gas emissions, that should not be construed as intimidating or overwhelming. Rather, it we see it as a motivating conclusion that makes three things obvious. The first is the urgency of accelerating action now, precisely because of the challenges of marshalling this extent of societal change. The second is that every step to significantly lower carbon emissions is important, because we must slow, if not stop, additional carbon loading. And the third is that progressive jurisdictions like Montgomery County should play a leading role in

modeling and demonstrating the feasibility of solutions for the rest of the state, country, and world.

It is clear that there is a strong need for the county to take urgent action in encouraging and getting ready for the inevitable tipping point that is almost upon us where gas-powered vehicles become a thing of the past. The county has an important role to play in preparing its community members to make this historic and important transition. Time is running short to have the necessary preparations in place as we make the shift to a new era of clean transportation. Legislative actions at the federal and state level (including the regional Transportation Climate Initiative - TCI) could work in synergy with the actions included in our spreadsheet to influence the marketplace and quicken the uptake of EVs and the retirement of all gasoline vehicles. It is tempting to conclude that this could all be done more efficiently on a broader scale. That might be true, but we do not control the broader scale, and we do control the county's part. Strong and innovative solutions by the county could become the floor for climate planning elsewhere.